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THE EFFECTS OF TACT AND LISTENER TRAINING ON THE EMERGENCE OF BIDIRECTIONAL INTRAVERBAL RELATIONS

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We evaluated the effects of 2 types of training on the emergence of bidirectional intraverbal relations with 4 typically developing children. Tact training involved reinforcing foreign-language vocalizations in the presence of visual stimuli, and listener training involved reinforcing selections of visual stimuli following vocal presentations of foreign-language words. Intraverbal relations were tested by instructing participants to vocalize native-language equivalents of foreign-language words or vice versa. Both types of training produced increases in intraverbal responding, but the emergent relations were not always bidirectional.

DESCRIPTORS: emergent relations, foreign-language instruction, intraverbals, listener behavior, tacts

Skinner (1957) described the intraverbal relation as a verbal response under the control of an antecedent verbal stimulus that does not have point-to-point correspondence with the response product. In the applied verbal behavior literature (e.g., Sundberg & Partington, 1998), this term has been used to describe a variety of educationally relevant outcomes of language training, such as answering social questions, reciting the alphabet, singing songs, telling stories, and describing stimuli in their absence. It has been argued that because academic and social behavior relies heavily on intraverbal repertoires, early childhood education should emphasize their establishment (Partington & Bailey, 1993; Sundberg & Michael, 2001).

A few studies have investigated the extent to which young children may derive novel intraverbal relations from the reinforcement of other relations. Two studies (Miguel, Petursdottir, & Carr, 2005; Partington & Bailey, 1993) evaluated the the effects of training multiple tact relations; that is, verbal responses in the presence of nonverbal stimuli (Skinner, 1957). Miguel et al. additionally trained the selection of nonverbal stimuli in the presence of verbal stimuli, sometimes termed *listener relations*, as did Petursdottir, Carr, Lechago, and Almason (2008). Across the three studies, tact and listener training had minimal effects on typically developing preschoolers' vocal intraverbal responding, suggesting that for young children, activities such as labeling and identifying stimuli in picture books and videos may not always suffice to expand intraverbal repertoires. However, all three studies investigated training in the context of teaching categorization skills. Having acquired relations between objects and their object names and category names, the participants were tested for the ability to emit either multiple object names given a category name (Miguel et al.; Partington & Bailey) or the same category name given multiple object names (Petursdottir et al.). Thus, the relations were hierarchical (i.e., ordered groupings within a system, as in the case of utensils [category] and knife [object within the category]). The present study was intended to provide a preliminary evaluation of the effects of tact and listener training on the emergence of bidirectional intraverbal relations

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in the context of a less complex, nonhierarchical task structure. To this effect, 4 children were taught a small foreign-language vocabulary in which a one-to-one relation existed between native-language and foreign-language nouns.

METHOD

Participants, Setting, and Materials

Ida, Emil, Lena, and Karen were 5 years old, spoke Icelandic as a native language, did not speak a second language, and participated in the study with their parents' permission. Sessions lasted 20 to 30 min and were conducted three to five times a week over a period of 2 to 4 weeks. Sessions took place in an empty preschool classroom, where the child and experimenter sat across from each other at a child-sized table. Visual stimuli consisted of laminated color photographs (8 cm by 10 cm) of six animals pictured in a natural environment and six fruits pictured against a white background. Prior to the experiment, the children could name (i.e., tact) all of the visual stimuli in Icelandic and vocally imitate their Spanish names.

Procedure

Tact and listener training. Emil and Ida received tact training, and Lena and Karen received listener training. Each child received training sequentially on two six-stimulus sets (fruits and animals). Training was conducted in six-trial blocks. On a tact training trial, the experimenter placed a visual stimulus on the table in front of the child and asked the Icelandic equivalent of "What is this [animal or fruit] called in Spanish?" A correct response was defined as vocalizing the Spanish name of the animal or fruit displayed on the picture. On a listener training trial, the experimenter placed three visual stimuli (all animals or all fruits) on the table and asked the Icelandic equivalent of "Which [animal or fruit] is called [Spanish name]?" A correct response was defined as touching the target stimulus. The experimenter delivered social praise contingent on correct responses in both types of training. If the child made an incorrect response, the experimenter prompted a correct response vocally (tact training) or by pointing (listener training). If the child did not make a response, the experimenter waited 10 s and then prompted a correct response. Training continued until 100% correct responding was achieved in three consecutive trial blocks.

Intraverbal testing. We used a multiple baseline design across stimulus sets to evaluate the effects of tact training (Ida and Emil) or listener training (Karen and Lena) on the acquisition of two types of intraverbal responding: Icelandic-Spanish intraverbals and Spanish-Icelandic intraverbals. Intraverbals were tested in baseline and following each training phase. Each trial block consisted of six Icelandic-Spanish and six Spanish-Icelandic trials. Trial presentation order varied across blocks. The experimenter initiated a Spanish-Icelandic trial by presenting the Icelandic equivalent of "What does [Spanish name] mean?" A correct response was defined as vocalizing the Icelandic equivalent of the Spanish name. The experimenter initiated an Icelandic-Spanish trial by presenting the Icelandic equivalent of "What is [Icelandic name] in Spanish?" A correct response was defined as vocalizing the Spanish equivalent of the Icelandic name. The experimenter did not present visual stimuli during test trials and did not deliver any consequences following correct or incorrect responses.

Data collection and interobserver agreement. During testing and training, the experimenter recorded correct and incorrect responses on data sheets. The experimenter recorded a correct response when the child emitted the target vocalization or selected the target visual stimulus and recorded an incorrect response if the child vocalized the name of or selected a different stimulus or did not respond within 10 s of trial initiation. The experimenter scored the child's first response if the child vocalized

multiple fruit or animal names. A second observer independently collected data on at least 40% of all testing and training trials for each child. An agreement was defined as both observers recording a correct response or both recording an incorrect response. Otherwise, a disagreement was scored. Point-by-point interobserver agreement for each trial block was calculated by dividing the number of agreements by the sum of agreements and disagreements and converting this ratio to a percentage. During testing, mean interobserver agreement was 100% for Emil, Ida, and Lena and 99% (range, 92% to 100%) for Karen. Mean agreement during training exceeded 97% for each child.

RESULTS AND DISCUSSION

Figure 1 shows intraverbal testing data for all participants. Correct intraverbals rarely occurred in baseline, but stable increases were observed following both types of training. The tact-trained participants (Emil and Ida) performed with high accuracy (overall >90% correct) in Icelandic-Spanish trials on both stimulus sets. In addition, their performance in Spanish-Icelandic trials was highly accurate (overall >90% correct) on the animals set, but Emil's performance was less accurate on the fruits set. The listener-trained participants (Lena and Karen) did not reach >90% overall levels of accuracy in either testing condition; however, Lena responded with 100% accuracy in Spanish-Icelandic trials during the last two blocks of testing on the animals set. Lena's performance in Icelandic-Spanish trials was consistently less accurate than her performance in Spanish-Icelandic trials, whereas Karen performed with similar accuracy in both conditions. In sum, tact training reliably resulted in the acquisition of an Icelandic-Spanish intraverbal repertoire and somewhat less reliably in the acquisition of Spanish-Icelandic intraverbals. The effects of listener training were more variable and typically resulted in only partial acquisition of the intraverbal relations.

Both types of training appeared to produce greater effects on intraverbal responding than those observed in prior research on emergent vocal intraverbal relations (Miguel et al., 2005; Partington & Bailey, 1993; Petursdottir et al., 2008). This might suggest that young children readily derive vocal intraverbal relations when those relations are not hierarchically structured, whereas a hierarchical structure might interfere with their emergence. However, the participants in the present study were slightly older or in the upper age range of those in earlier studies, and as a result, developmental differences cannot be ruled out. Although tact training appeared to have a stronger effect on the intraverbal repertoire than did listener training, these data should be interpreted with caution, because no within-subject evaluation was conducted to compare the effects of the two types of training. In addition, the tact-trained children were exposed to more training trials ($M = 53.7$ trial blocks) than the listener-trained children ($M = 33.8$ trial blocks) before they reached the training criterion (acquisition data are available from the first author).

One finding of interest, however, is that training did not necessarily result in equal accuracy on both of the tested relations. When Lena was vocally presented with Spanish words following listener training, she emitted their Icelandic equivalents with fairly high accuracy, but when she was vocally presented with those same Icelandic words, she rarely emitted correct Spanish responses. Also, following tact training on his first stimulus set, Emil's intraverbal responding was more accurate in Spanish than in his native Icelandic language. These findings suggest that emergent intraverbal relations are not necessarily bidirectional, along with the possibility that the training of different relations (e.g., tacts vs. listener relations) may differentially affect which type of unidirectional relation emerges. This finding may be related to the role

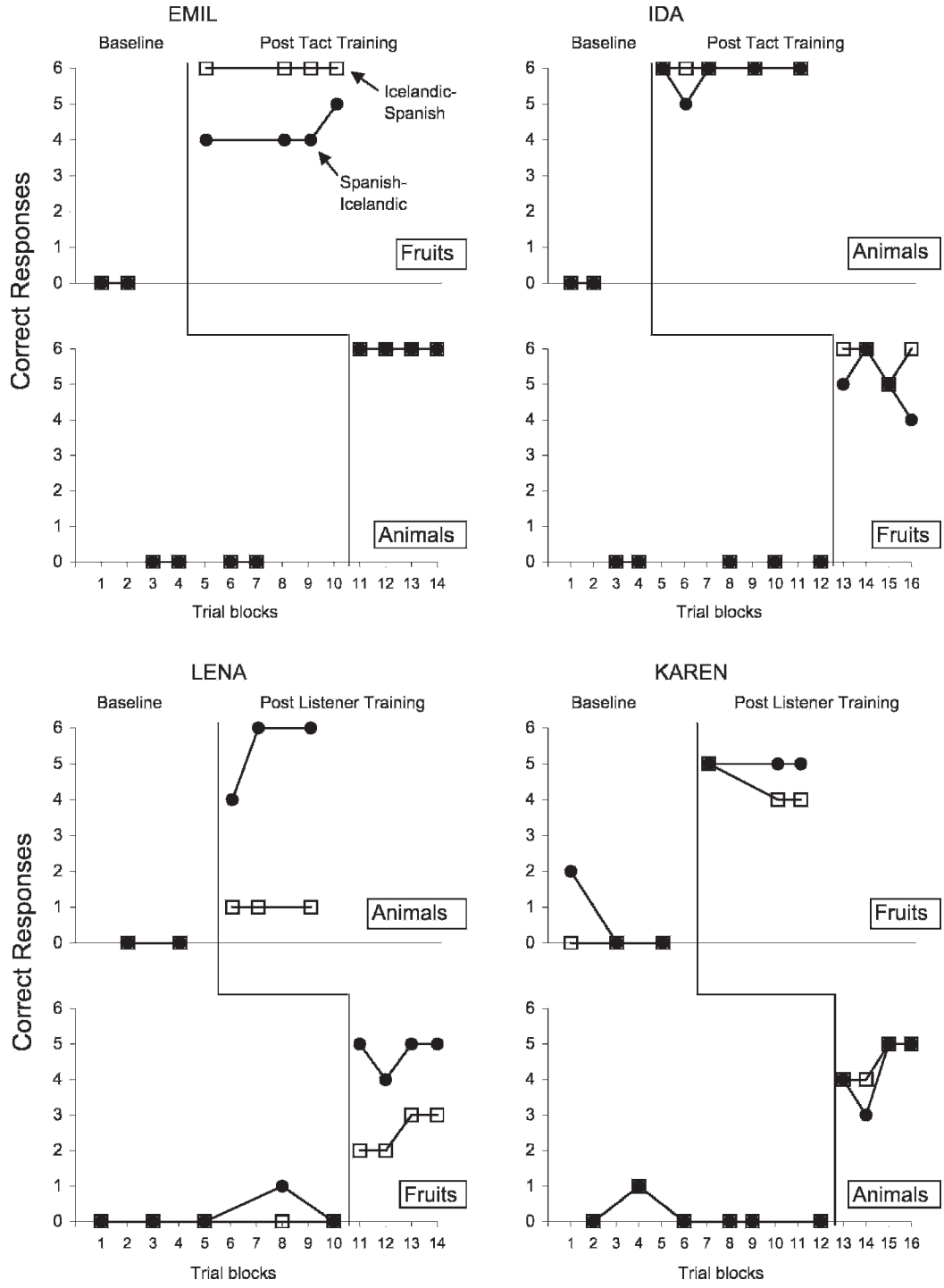

Figure 1. The number of correct responses on Icelandic-Spanish and Spanish-Icelandic intraverbal test trials in baseline and following the completion of tact training (top two panels) and listener training (bottom two panels).

of the novel Spanish words as either responses or discriminative stimuli (S^Ds) during training and testing. Tact training directly established the Spanish vocalizations required on Icelandic-Spanish test trials but did not establish stimulus control over any kind of responding by the Spanish names presented in Spanish-Icelandic trials. Listener training, by contrast, established stimulus control by Spanish words over selection responses, but no Spanish vocalizations were required. Keeping this in mind, a verbal behavior analysis (Skinner, 1957) might suggest that if during training, the children were to tact the visual stimuli in Icelandic prior to selecting them or tacting them in Spanish, those tacts alone could suffice to establish the intraverbal relation that shared a common response form or a common S^D with the trained relation. By contrast, additional processes would be necessary for the emergence of the opposite relation. Although we did not monitor the occurrence of Icelandic tacts, it is possible that they occurred either overtly or covertly. Future research might examine further the role of existing tacts in the indirect establishment of novel intraverbal relations and explore practical and conceptual (cf. Horne & Lowe, 1996) implications of unidirectional versus bidirectional intraverbals.

It should be noted that the similarity of the instruction used on tact training trials and Icelandic-Spanish test trials may have facilitated responding on test trials as a result of the verbal stimulus ''Spanish'' acquiring some degree of control over Spanish-language vocalizations. However, because this stimulus was present on all tact and Icelandic-Spanish trials, the specific form of the response must have been controlled by the visual stimulus on tact trials and by the relevant vocal stimulus (Icelandic fruit or animal name) on Icelandic-Spanish trials. Exclusive intraverbal control by ''Spanish'' would result in one of the six responses being correct by chance (assuming a repertoire of the six Spanish responses in the set) and therefore cannot explain why tacts were acquired to criterion and Icelandic-Spanish intraverbals were typically emitted with 100% accuracy. More likely, instructions on test trials functioned as contextual stimuli that prompted the child to vocalize some name in either Spanish or Icelandic.

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